

What is claimed is:

1. An implant assembly adapted to be fixed to a bone using at least one bone screw having a thinner region and a thicker region, which implant assembly comprises:

5 an implant member, which implant member has an aperture extending through the implant member, wherein the aperture includes a first region sized to permit the thinner region of the bone screw but not the thicker region of the bone screw to pass through and the aperture includes a second region sized to permit both the thinner region of the bone screw and the thicker region of the bone screw to pass through;

10 a first interior perimeter surface in the implant member defined by the first region of the aperture;

a second interior perimeter surface in the implant member defined by the second region of the aperture; and

15 a washer disposed within the aperture in the second region thereof, which washer has a hole large enough to permit both the thinner region of the bone screw and the thicker region of the bone screw to pass through and which washer has at least a first region with a first wall thickness and a second region with a second wall thickness, wherein the first wall thickness is greater than the second wall thickness;

20 wherein, when the bone screw is inserted in the aperture of the implant member and the hole of the washer such that the thicker region of the bone screw is in the second region of the aperture, rotation of the washer causes movement of the first region of the washer relative to the second interior perimeter surface such that the washer applies force to the bone screw to press the bone screw against the implant member and to fix the bone screw in orientation relative to the implant member.

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2. The implant assembly of claim 1, wherein the second interior perimeter surface includes a recess in at least a portion thereof, and at least a portion of the washer enters the recess.

3. The implant assembly of claim 2, wherein the recess includes at least a first region and a second region, and wherein the recess is shallower in the first region than in the second region.

5 4. The implant assembly of claim 3, wherein, when the bone screw is inserted in the aperture of the implant member and the hole of the washer such that the thicker region of the bone screw is in the second region of the aperture, rotation of the washer causes movement of the first region of the washer from the first region of the recess to the second region of the recess such that the washer applies force to the bone screw to
10 press the bone screw against the implant member and to fix the bone screw in orientation relative to the implant member.

5. The implant assembly of claim 1, wherein the washer applies force to the bone screw to press the bone screw against the first interior perimeter surface.

15 6. The implant assembly of claim 5, wherein the bone screw includes grooves, at least a portion of which grooves are brought into contact with the first interior perimeter surface when the washer applies force to the bone screw to press the bone screw against the first interior perimeter surface.

20 7. The implant assembly of claim 5, wherein the first region of the aperture is shaped such that the first interior perimeter surface provides two lines of contact with the bone screw as the bone screw is pressed against the first interior perimeter surface by the washer.

25 8. The implant assembly of claim 1, further comprising a detent disposed on the washer, wherein the detent engages the second interior perimeter surface to provide sufficient friction to prohibit the washer from rotating due to contact with the bone screw as the bone screw is screwed into the bone.

9. The implant assembly of claim 8, further comprising an indentation in the second interior perimeter surface, wherein the detent engages the indentation to provide sufficient friction to prohibit the washer from rotating due to contact with the bone screw as the bone screw is screwed into the bone.

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10. The implant assembly of claim 1, wherein the implant member has a top surface and a bottom surface, wherein the first region of the aperture is adjacent the bottom surface of the implant member, and wherein the second region of the aperture is adjacent the top surface of the implant member.

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11. The implant assembly of claim 10, wherein the first region of the aperture tapers from wider to narrower in a direction moving from the top surface of the implant member towards the bottom surface of the implant member.

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12. The implant assembly of claim 11, wherein the bone screw is inserted from the top surface of the implant member towards the bottom surface of the implant member.

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13. The implant assembly of claim 10, wherein the bottom surface of the implant member is contoured to substantially match a contour of the bone to which the implant member is affixed.

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14. The implant assembly of claim 1, wherein the implant assembly is used for performing at least one of: (a) fusing at least two bones; and (b) healing a fracture in a bone.

15. The implant assembly of claim 1, wherein the thinner region of the bone screw includes a threaded shank and the thicker region of the bone screw includes a head.

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16. The implant assembly of claim 15, wherein the head of the bone screw includes a mechanism for engaging a driving tool.

17. The implant assembly of claim 16, wherein the mechanism for engaging the driving tool is a hex socket.

5 18. The implant assembly of claim 1, wherein the washer includes a mechanism for engaging a driving tool.

19. The implant assembly of claim 18, wherein the mechanism for engaging the driving tool is a spline.

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20. An implant assembly adapted to be fixed to a bone using at least two bone screws, each of the bone screws having a thinner region and a thicker region, which implant assembly comprises:

15 an implant member, which implant member has a top surface and a bottom surface and which implant member has at least two apertures extending therethrough, wherein each aperture includes a lower region sized to permit the thinner region of one of the bone screws but not the thicker region of one of the bone screws to pass through, wherein each aperture includes an upper region sized to permit both the thinner region of one of the bone screws and the thicker region of one of the bone screws to pass through, and wherein the lower region of the aperture is adjacent the bottom surface of the implant member and the upper region of the aperture is adjacent the top surface of the implant member;

20 at least two lower interior perimeter surfaces in the implant member, each of which lower interior perimeter surfaces is defined by the lower region of a respective one of the apertures;

25 at least two upper interior perimeter surfaces in the implant member, each of which upper interior perimeter surfaces is defined by the upper region of a respective one of the apertures; and

30 at least two washers, each of which washers is disposed within the upper region of a respective one of the apertures, wherein each washer has a hole large enough to permit both the thinner region of one of the bone screws and the thicker region of one of the

bone screws to pass through, wherein each washer has at least a first region with a first wall thickness and a second region with a second wall thickness, and wherein the first wall thickness is greater than the second wall thickness;

5 wherein each upper interior perimeter surface includes a recess in at least a portion thereof;

wherein at least a portion of each washer enters a respective one of the recesses;
wherein each recess includes at least a first region and a second region such that each recess is shallower in the first region than in the second region; and

10 wherein, when each of the bone screws is inserted in a respective aperture of the implant member and a hole of a respective one of the washers such that the thicker region of the bone screw is in the upper region of the aperture, rotation of the washer causes movement of the first region of the washer from the first region of the respective recess to the second region of the recess such that the washer applies force to the bone screw to press the bone screw against the implant member and to fix the bone screw in orientation
15 relative to the implant member.

21. The implant assembly of claim 20, wherein each recess defines an interface surface between the upper interior perimeter surface and the lower interior perimeter surface and each washer applies force to a respective bone screw to press the bone screw
20 against at least one of a respective lower interior perimeter surface and a respective interface surface.

22. The implant assembly of claim 21, wherein each bone screw includes grooves, at least a portion of which grooves are brought into contact with at least one of a
25 respective lower interior perimeter surface and a respective interface surface when each washer applies force to a respective bone screw to press the bone screw against at least one of a respective lower interior perimeter surface and a respective interface surface.

23. The implant assembly of claim 21, wherein the lower region of each aperture
30 is shaped such that the lower interior perimeter surface provides two lines of contact with

a respective bone screw as a respective bone screw is pressed against the lower interior perimeter surface by a respective washer.

5 24. The implant assembly of claim 20, further comprising a detent disposed on each of the washers, wherein each detent engages a respective upper interior perimeter surface to provide sufficient friction to prohibit each washer from rotating due to contact with a respective bone screw as the bone screw is screwed into the bone.

10 25. The implant assembly of claim 24, further comprising an indentation in each of the second interior perimeter surfaces, wherein a respective detent engages a respective indentation to provide sufficient friction to prohibit each washer from rotating due to contact with a respective bone screw as the bone screw is screwed into the bone.

15 26. The implant assembly of claim 20, wherein the lower region of each aperture tapers from wider to narrower in a direction moving from the top surface of the implant member towards the bottom surface of the implant member.

20 27. The implant assembly of claim 26, wherein each bone screw is inserted from the top surface of the implant member towards the bottom surface of the implant member.

25 28. The implant assembly of claim 20, wherein the bottom surface of the implant member is contoured to substantially match a contour of the bone to which the implant member is affixed.

29. The implant assembly of claim 20, wherein the implant assembly is used for performing at least one of: (a) fusing at least two bones; and (b) healing a fracture in a bone.

30. The implant assembly of claim 20, wherein the thinner region of each bone screw includes a threaded shank and the thicker region of each bone screw includes a head.

5 31. The implant assembly of claim 30, wherein the head of each bone screw includes a mechanism for engaging a driving tool.

32. The implant assembly of claim 31, wherein the mechanism for engaging the driving tool is a hex socket.

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33. The implant assembly of claim 20, wherein each washer includes a mechanism for engaging a driving tool.

15 34. The implant assembly of claim 33, wherein the mechanism for engaging the driving tool is a spline.

35. The implant assembly of claim 20, wherein the implant member includes between 2 and 8 apertures.

20 36. The implant assembly of claim 35, wherein the implant assembly includes the same number of washers as apertures.

37. A bone screw assembly, comprising:
a bone screw with a head and a shank, which bone screw includes at least one
25 mounting member extending from the head in a direction generally away from the shank;
and

a washer with a central opening and an outer periphery, which washer includes at least one splay along the outer periphery and at least one track between the outer periphery and the central opening, wherein the splay is defined by the track;

wherein the mounting member is adapted to operatively engage the track such that rotation of the washer relative to the bone screw causes the mounting member to force the splay outwards, away from the central opening.

5 38. The bone screw assembly of claim 37, comprising a plurality of mounting members and a respective plurality of splays and tracks.

39. The bone screw assembly of claim 38, wherein each mounting member is adapted to operatively engage a respective track such that rotation of the washer relative
10 to the bone screw causes each mounting member to force a respective splay outwards, away from the central opening.

40. The bone screw assembly of claim 39, wherein each track has a narrowed intermediate portion against which each respective mounting member contacts to force
15 each respective splay outward.

41. The bone screw assembly of claim 39, wherein the bone screw assembly is adapted to affix an implant member to bone.

20 42. The bone screw assembly of claim 41, wherein the implant member has at least one aperture extending therethrough and the aperture includes a first region sized to permit the shank of the bone screw but not the head of the bone screw to pass through and a second region sized to permit both the shank of the bone screw and the head of the bone screw to pass through.

25 43. The bone screw assembly of claim 42, wherein the washer is sized to pass through the second region of the implant member but not the first region of the implant member.

30 44. The bone screw assembly of claim 43, wherein a first interior perimeter surface in the implant member is defined by the first region of the aperture, wherein a

second interior perimeter surface in the implant member is defined by the second region of the aperture, and wherein each of the mounting members is adapted to operatively engage a respective track such that rotation of the washer relative to the bone screw causes each mounting member to force a respective splay outwards, away from the central opening and into contact with the second interior perimeter surface to fix the bone screw in orientation relative to the implant member.

45. The bone screw assembly of claim 44, wherein the second interior perimeter surface includes a recess in at least a portion thereof, and wherein each of the mounting members is adapted to operatively engage a respective track such that rotation of the washer relative to the bone screw causes each mounting member to force a respective splay outwards, away from the central opening and into contact with the recess to fix the bone screw in orientation relative to the implant member.

46. The bone screw assembly of claim 44, wherein the bone screw includes grooves, at least a portion of which grooves are brought into contact with the implant member when each mounting member forces a respective the splay outwards, away from the central opening and into contact with the second interior perimeter surface.

47. The bone screw assembly of claim 41, wherein the implant member has a top surface and a bottom surface, wherein the first region of the aperture is adjacent the bottom surface of the implant member, and wherein the second region of the aperture is adjacent the top surface of the implant member.

48. The bone screw assembly of claim 47, wherein the first region of the aperture tapers from wider to narrower in a direction moving from the top surface of the implant member towards the bottom surface of the implant member.

49. The bone screw assembly of claim 48, wherein the bone screw is inserted from the top surface of the implant member towards the bottom surface of the implant member.

50. The bone screw assembly of claim 47, wherein the bottom surface of the implant member is contoured to substantially match a contour of the bone to which the implant member is affixed.

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51. The bone screw assembly of claim 41, wherein the implant member is used for performing at least one of: (a) fusing at least two bones; and (b) healing a fracture in a bone.

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52. The bone screw assembly of claim 37, wherein the head of the bone screw includes a mechanism for engaging a driving tool.

53. The bone screw assembly of claim 52, wherein the mechanism for engaging the driving tool is a hex socket.

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54. The bone screw assembly of claim 37, wherein the washer includes a mechanism for engaging a driving tool.

55. The bone screw assembly of claim 54, wherein the mechanism for engaging the driving tool comprises at least one lobe disposed adjacent the central opening.

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56. An implant assembly adapted to be fixed to a bone using at least one bone screw having a shank and a head, which implant assembly comprises:

an implant member, which implant member has at least one aperture extending through the implant member, wherein the aperture includes a first region sized to permit the shank of the bone screw but not the head of the bone screw to pass through and the aperture includes a second region sized to permit both the shank of the bone screw and the head of the bone screw to pass through; and

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at least one movable containment member, which moveable containment member is slidably attached to the implant member;

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wherein the moveable containment member is slideable to a first position in which the bone screw may be inserted in the aperture such that the shank of the bone screw passes into the first region and the head of the bone screw remains in the second region; and

5 wherein the moveable containment member is slideable to a second position in which the head of the bone screw is at least partially covered by the moveable containment member.

10 57. The implant assembly of claim 56, wherein the bone screw is blocked from being removed from the implant member while the moveable containment member is in the second position.

15 58. A bone screw, comprising:
a shank;
a head at one end of the shank; and
at least one deformable member attached to the head at a position opposite the shank;
wherein the deformable member is adapted to be deformable outwards, away from a central axis of the bone screw.

20 59. The bone screw of claim 58, comprising a plurality of deformable members arranged around the head.

25 60. The bone screw of claim 59, wherein the plurality of deformable members are arranged around the head to define an interior space.

61. The bone screw of claim 60, further comprising a cam mechanism disposed within the interior space.

62. The bone screw of claim 61, wherein the cam mechanism is configured to deform the deformable members outwards when the cam mechanism is rotated relative to the head.

5 63. The bone screw of claim 62, wherein the bone screw is adapted to affix an implant member to bone.

64. The bone screw of claim 63, wherein the implant member has at least one aperture extending therethrough and the aperture includes a first region sized to permit
10 the shank of the bone screw but not the head of the bone screw to pass through and a second region sized to permit both the shank of the bone screw and the head of the bone screw to pass through.

65. The bone screw of claim 64, wherein a first interior perimeter surface in the
15 implant member is defined by the first region of the aperture, wherein a second interior perimeter surface in the implant member is defined by the second region of the aperture, and wherein each of the deformable members is adapted to deform outwards, when the cam is rotated relative to the head, to come into contact with the second interior perimeter surface to fix the bone screw in orientation relative to the implant member.

20 66. The bone screw of claim 65, wherein the second interior perimeter surface includes a recess in at least a portion thereof, and each deformable member is adapted to deform outwards, when the cam is rotated relative to the head, to come into contact with the recess to fix the bone screw in orientation relative to the implant member.

25 67. The bone screw of claim 65, wherein the bone screw includes grooves, at least a portion of which grooves are brought into contact with the implant member when each deformable member deforms outwards to come into contact with the second interior perimeter surface.

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68. The bone screw of claim 63, wherein the implant member has a top surface and a bottom surface, wherein the first region of the aperture is adjacent the bottom surface of the implant member, and wherein the second region of the aperture is adjacent the top surface of the implant member.

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69. The bone screw of claim 68, wherein the first region of the aperture tapers from wider to narrower in a direction moving from the top surface of the implant member towards the bottom surface of the implant member.

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70. The bone screw of claim 69, wherein the bone screw is inserted from the top surface of the implant member towards the bottom surface of the implant member.

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71. The bone screw of claim 68, wherein the bottom surface of the implant member is contoured to substantially match a contour of the bone to which the implant member is affixed.

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72. The bone screw of claim 63, wherein the implant member is used for performing at least one of: (a) fusing at least two bones; and (b) healing a fracture in a bone.

73. The bone screw of claim 58, wherein the head of the bone screw includes a mechanism for engaging a driving tool.

74. The bone screw of claim 73, wherein the mechanism for engaging the driving tool comprises a hex socket.

75. The bone screw of claim 61, wherein the cam includes a mechanism for engaging a driving tool.

76. The bone screw of claim 75, wherein the mechanism for engaging the driving tool comprises at least one lobe disposed adjacent the central opening.

77. The implant assembly of claim 1, wherein the washer is a split-ring washer.

78. The implant assembly of claim 20, wherein at least one of the washers is a
5 split-ring washer.

79. The bone screw assembly of claim 37, wherein the washer is a split-ring
washer.